



# Books & Reports

## Radar for Monitoring Hurricanes From Geostationary Orbit

A document describes a scanning Doppler radar system to be placed in a geostationary orbit for monitoring the three-dimensional structures of hurricanes, cyclones, and severe storms in general. The system would operate at a frequency of 35 GHz. It would include a large deployable spherical antenna reflector, instead of conventional paraboloidal reflectors, that would allow the reflector to remain stationary while moving the antenna feed(s), and thus, create a set of scanning antenna beams without degradation of performance. The radar would have separate transmitting and receiving antenna feeds moving in spiral scans over an angular excursion of 4° from the boresight axis to providing one radar image per hour of a circular surface area of 5,300-km diameter. The system would utilize a real-time pulse-compression technique to obtain 300-m vertical resolution without sacrificing detection sensitivity and without need for a high-peak-

power transmitter. An onboard data-processing subsystem would generate three-dimensional rainfall reflectivity and Doppler observations with 13-km horizontal resolution and line-of-sight Doppler velocity at a precision of 0.3 m/s.

*This work was done by Eastwood Im, Stephen Durden, John Huang, Michael Lou, Eric Smith, and Yahya Rahmat-Samii of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

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(KBR) instrument, and an ultra-stable oscillator (USO) that serves as a clock for the GPS and KBR units. The long-term errors of the USOs are cancelled by use of a technique, called dual-one-way phase measurements, in which the phases of the KBR signals from spacecraft A as measured at spacecraft B are added to the phases of the KBR signals from spacecraft B as measured at spacecraft A. GPS data are used to synchronize time between the USOs to within ≈150 ps as needed to enable the dual-one-way phase measurements: For each spacecraft, the GPS data are used to solve for orbital positions, and the difference between the onboard clocks and a ground clock every 5 minutes. The relative clock rate between the spacecraft is then determined from the difference between the two solutions.

*This work was done by William Bertiger, Seen-Chong Wu, Gerhard Kruizinga, Charles Dunn, and Larry Romans of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

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## Time-Transfer System for Two Orbiting Spacecraft

A report describes the time-transfer system of the Gravity Recovery and Climate Experiment (GRACE), in which information on the distribution of Earth mass is extracted from position and time measurements for two spacecraft about 200 km apart in a circular, nearly polar orbit. Each spacecraft carries a Global Positioning System (GPS) receiver, a K/Ka-band ranging